REMARKS

The rejection of claims 1 to 9 and 10 to 13 under 35 U.S.C. 103(a) as being unpatentable over Kondo et al. (US 2002/0048076 Al) in view of Lee et al. (US 2001/0035123 Al), and further in view of Yachi at al. (US 5,925,968) and Durand et al. (US 5,183,593).

The present invention as defined in pending claims 1, 2, 3, 5, 8, and 10 to 13 as amended, is directed to a method for preparing a film structure of a ferroelectric single crystal, which comprises adhering a ferroelectric single crystal plate to a substrate by a conductive adhesive, wherein the ferroelectric single crystal is a material having the composition of formula (I) and the conductive adhesive is a gold- or silver- containing epoxy paste, or a Pt containing adhesive sol.

Specifically, in the present invention, a film of a lead magnesium niobate-lead titanate (PMN-PT) or lead zinc niobate-lead titanate (PZN-PT) based single crystal material is adhered to a substrate by a conductive adhesive such as gold- or silver-containing epoxy paste, or a Pt containing adhesive sol.

By way of review, Kondo et al. cited as the primary reference discloses a traveling wave- type optical modulator comprising a supporting substrate and a ferroelectric crystalline layer, on the supporting substrate, having thicker parts and thinner parts; and, further, a method of preparing wave-type optical modulator including the steps of adhering a substrate made of a ferroelectric single crystalline material to

another supporting substrate and processing the substrate so as to have thicker parts and thinner parts. Kondo et al. explains that in a traveling wave-type optical modulator including a substrate made of a ferroelectric single crystal having thicker parts and thinner parts, the optical insertion loss and the product (V_{TT}-L) can be decreased by matching the velocity of the microwave signal and the impedance for an external circuit *(see* paragraphs [0006] [0007] [0066] and [00881).

With regard to the step of adhering the substrate to yet another substrate, Kondo et al. describes that a ferroelectric single crystal such as lithium niobate single crystal *(see* paragraphs [0057] [0075] and [0083]) can be adhered to another supporting substrate by an adhesive layer made of a solder glass material such as silicon oxide, etc or a resin material such as epoxy-based resin film *(see* paragraphs [0021] and [0064]).

Lee et al, cited as a secondary reference, was filed by the same inventors as in the present invention and describes a novel ferroelectric single crystal wafer having the composition of formula (I), i.e., a lead magnesium niobate-lead titanate (PMN-PT) material or a lead zinc niobate-lead titanate (PZN-PT) based material. However, Lee et al. does not describe or suggest combining the ferroelectric single crystal wafer with a substrate material or how this is to be accomplished. Lee et al. teaches a PMN-PT and PZN-PT based single crystal wafer but is totally silent as to any process for combining a wafer of this composition to a substrate.

Durand et al. was cited as an additional secondary reference and is directed to an electrically conductive cement comprising a mixture comprised of conductive filler particles dispersed in a shrinkable adhesive polymeric carrier. Durand et al. explains the term 'conductive cement' as used therein means any composition or material used to establish electrical contact and a mechanical connection of separate bodies, e.g., a lead to a connection pad (see col_2, lines 41 to 44), and, further, the object of Durand et al. is to provide a conductive cement having improved performance characteristics under high humidity and/or temperature when used to connect high pin count, surface mount devices, and other electronic components which utilize ordinary metal finishes such as solder plate and tin plate to a substrate (*see* col. 4, lines 35 to 42). In the working example of Durand et al., a conductive cement comprising silver particulates and a mixture of epoxy resins was used to connect a 68-pin surface-mount device (SMD), a 44-pin surface mount device, and a series connected resister string in each of test circuits (*see* Example II).

Yachi et al. cited as another additional secondary reference provides a piezoelectric vibrator including piezoelectric element 10 mounted on and attached to a board or substrate by means of electrically conductive adhesive layers 15 and 16 made of, for example, Ag paste, wherein the adhesive layers 15 and 16 have fixing portions 15a and 16a, respectively, which are in contact with the substrate so that the piezoelectric element 10 is supported over the substrate and can vibrate freely (*see* col, 7, lines 22 to 37 and Fig. 8).

As pointed out by the Examiner, Kondo et al. discloses preparing a traveling wave- type optical modulator by adhering *a ferroelectric single crystal plate such as lithium niobate* to a substrate with an *epoxy based resin film*. However, Kondo et al does not teach a process for adhering a ferroelectric single crystal wafer having the composition of formula (I), i.e., lead magnesium niobate-lead titanate (PMN-PT) based material or lead zinc niobate-lead titanate (PZN-PT) based material to a substrate using a conductive adhesive comprises of gold- or silver-containing epoxy paste, or a Pt containing adhesive sol, which is the essential feature of the present invention.

Although Durand et al. and Yachi et al. teach the use of a silver containing epoxy paste or resin, the two cited references are different from the present invention in that they fail to disclose <u>a film structure of a ferroelectric single crystal adhered to a substrate.</u> That is, as discussed above, Durand et al. teaches only that a composition comprising silver particulate and epoxy resin can be used to connect high pin count, surface mount devices, and other electronic components in an integrated circuit. Further, Yachi et al. explicitly shows that the Ag paste was used to support a piezoelectric element, e.g., by means of the fixing portions 15a and 16a shown in Fig 8, *over* a substrate so that it can vibrate freely. Accordingly, no one skilled in the art would interpret either reference to suggest using the silver containing epoxy to adhere a ferroelectric single crystal to a substrate.

The present invention is a process not a composition and comprises adhering a ferroelectric single crystal plate having the composition of formula (I) to a substrate using a conductive adhesive comprising a gold- or silver- containing epoxy paste, or a Pt containing adhesive sol to obtain a film structure thereof. This inventive process produces a high performance single crystal film structure in which the adhesion process bonds the PMN-PT and PZN-PT single crystal to a substrate at low temperature which permits an inexpensive metal such as aluminum having a lower melting point to be employed as an electrode material *(see* page 5 of the originally filed specification).

The film structure of the single crystal prepared by the inventive method may be successfully used in the fabrication of different electric or electronic parts such as microactuators, ultrasonic probes, variable filters, film bulk acoustic resonators and the like.

Accordingly, it is submitted that the structures obtained by using a silver containing epoxy paste or resin in Durand et al. and Yachi et al. are being used in a dissimilar application completely different from that of the present invention which deals with adhering a film structure of a specific type of ferroelectric single crystal to substrate. Neither Lee et al, Durand et al. nor Yachi et al. suggest this use.

The Examiner has also cited Fujoka et al., Suenaga et al_, Yasumoto et al., and Kijima et al. as other prior art references pertaining to the present invention.

However, none of these prior art references discloses any process for preparing a film structure of a ferroelectric single crystal by using a conductive adhesive, and, accordingly, any of them cannot make the present invention obvious.

As discussed above, it is believed that the unique feature of the present invention as well as the beneficial effect arising therefrom are not taught, suggested or implied by the cited references, even if they are combined. Therefore, the present invention defined in claims 1, 2, 3, 5, 8, and 10 to 13 is clearly patentable and unobvious over the cited references either alone or combined.

Respectfully submitted,

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I hereby certify that this correspondence is being sent to the USPTO via EFS Web to the Commissioner for Patents, P.O. Box 1450, Alexandria VA 22313-1450, MAIL STOP: AMENDMENT, on June 17, 2008.

By ______________________